

NOTE: The document identifier and heading has been changed on this page to reflect that this is a performance specification. There are no other changes to this document. The document identifier on subsequent pages has not been changed, but will be changed the next time this document is revised.

INCH-POUND

MIL-PRF-49462A  
15 March 1991  
SUPERSEDING  
MIL-R-49462  
4 March 1987

## PERFORMANCE SPECIFICATION

### RESISTORS, FIXED, FILM, HIGH VOLTAGE GENERAL SPECIFICATION FOR

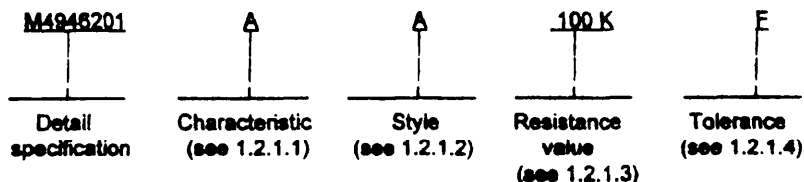
This specification is approved for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers the general requirements for fixed, film, high voltage resistors primary intended for incorporation into electronic circuits where high voltages and high resistance values are present.

#### 1.2 Classification.

1.2.1 Part of Identifying Number (PIN). Resistors specified herein shall be identified by a PIN which shall consist of a basic number of the associated detail specification and a coded number. Each associated detail specification covers a different resistor type. The number shall be coded to provide information concerning resistor type, resistance value, and tolerance. The PIN shall be in the following form with a coded number derived as indicated.



1.2.1.1 Characteristic. The characteristic shall be identified by a single letter A, B, C, and D in accordance with table I.

1.2.1.2 Style. The style shall be identified by a single letter (see 3.1). The letters available are A, B, C, D, E, F, G, H, J, K, M, N.

1.2.1.3 Resistance. The nominal resistance expressed in ohms is identified by four characters, consisting of three digits and a letter. The letter is used simultaneously as a decimal point and as a multiplier. For resistance values:

- Greater than or equal to 1 ohm but less than 1 kilohm, the letter "R" is used to represent a decimal point.
- Greater than or equal to 1 kilohm but less than 1 megohm, the letter "K" is used to represent a decimal point.
- Greater than or equal to 1 megohm but less than 1 gigohm, the letter "M" is used to represent a decimal point.
- Greater than or equal to 1 gigohm but less than 1 teraohm, the letter "G" is used to represent a decimal point.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: DESC-ELDM, 1507 Wilmington Pike, Dayton, OH 45444-5765 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 5905

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

- e. Greater than or equal to 1 teraohm, the letter "T" is used to represent a decimal point.

All digits preceeding and following the letter (R, K, M, G, T) of the group represent significant figures. The resistance values designations are shown in table II. The minimum and maximum resistance shall be specified herein. The standard values for every decade shall follow the sequence specified in table III.

1.2.1.4 Resistance tolerance. The resistance tolerance is identified by a single letter in accordance with table IV.

## 2. APPLICABLE DOCUMENTS

### 2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in solicitation (see 6.2).

#### SPECIFICATIONS

##### MILITARY

MIL-R-39032 - Resistors, Packaging of.

#### STANDARDS

##### MILITARY

MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.  
 MIL-STD-1276 - Leads, Weldable, for Electronic Component Parts.  
 MIL-STD-1285 - Marking of Electrical and Electronic Parts.  
 MIL-STD-45662 - Calibration Systems Requirements.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

#### AMERICAN SOCIETY FOR TESTING AND MATERIAL (ASTM)

ASTM E-595-83 - Total Mass Loss and Collected Volatile Condensable Materials From Outgassing in a Vacuum Environment.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence. Nothing in this specification, however shall supersede applicable laws and regulations unless a specific exemption has been obtained.

TABLE I. Characteristics.

Test or condition	Characteristic A	Characteristic B	Characteristic C	Characteristic D
Maximum resistance temperature characteristic percent/°C part/million/°C	<500 Mo = 200 ppm ≥500 Mo = 500 ppm	<500 Mo = 200 ppm ≥500 Mo = 500 ppm	<500 Mo = 200 ppm ≥500 Mo = 500 ppm	<500 Mo = 200 ppm ≥500 Mo = 500 ppm
Maximum ambient temperature at rated power	+70°C	+125°C	+125°C	+70°C
Maximum ambient temperature at zero wattage derating	+175°C	+225°C	+175°C	+220°C
Power rating in watts and maximum dc or rms voltage:  RHY10, RHY36 RHY11, RHY37 RHY12, RHY38 RHY13, RHY39 RHY14, RHY40 RHY15, RHY41 RHY16, RHY42 RHY17, RHY43 RHY18, RHY44 RHY19, RHY45 RHY20, RHY46 RHY21, RHY47	N/A	0.5 W 1.5 kV 1.0 W 2.0 kV 1.5 W 5.0 kV 2.0 W 6.0 kV 2.5 W 11.0 kV 3.0 W 15.0 kV 5.0 W 22.5 kV 6.0 W 30.0 kV 7.5 W 15.0 kV 8.0 W 20.0 kV 10.0 W 25.0 kV 15.0 W 30.0 kV	N/A	N/A
RHY22 RHY23 RHY24 RHY25 RHY26 RHY27 RHY28 RHY29	N/A	N/A	0.50 W 1.5 kV 1.60 W 3.5 kV 4.00 W 7.5 kV 5.00 W 25.0 kV 0.25 W 3.75 kV 0.80 W 7.5 kV 1.50 W 11.25 kV 2.00 W 15.0 kV	N/A
RHY30 RHY31 RHY32 RHY33 RHY34 RHY35	0.25 W 750 V 0.5 W 1.5 kV 1.0 W 3.0 kV 2.0 W 5.0 kV 3.0 W 10.0 kV 5.0 W 20.0 kV	N/A	N/A	N/A

TABLE I. Characteristics - Continued.

Test or condition	Characteristic A	Characteristic B	Characteristic C	Characteristic D
RHY50 RHY51 RHY52 RHY53 RHY54 RHY55 RHY56 RHY57	N/A	N/A	N/A	0.75 W 2.0 kV 1.00 W 2.5 kV 1.50 W 5.0 kV 2.00 W 10.0 kV 4.00 W 8.0 kV 7.00 W 16.0 kV 10.00 W 24.0 kV 12.00 W 32.0 kV
Maximum percent change in resistance (*):				
Thermal shock	0.5	0.5	0.5	0.5
Dielectric with- standing voltage	0.25	0.25	0.25	0.25
Life	5.0	5.0	5.0	5.0
Shock	2.0	2.0	2.0	2.0
Terminal strength	0.2	0.2	0.2	0.2
Vibration, high frequency	2.0	2.0	2.0	2.0
Low temperature operation	0.25	0.25	0.25	0.25
Resistance tolerance (*) percent	1, 2, 5	1, 2, 5	1, 2, 5	1, 2, 5

TABLE II. Designation of resistance.

Designation	Resistance
10R0 to 97R6	10 $\Omega$ to 97.6 $\Omega$
100R to 976R	100 $\Omega$ to 976 $\Omega$
1K00 to 9K76	1 k $\Omega$ to 9.76 k $\Omega$
10K0 to 97K6	10 k $\Omega$ to 97.6 k $\Omega$
100K to 976K	100 k $\Omega$ to 976 k $\Omega$
1M00 to 9M76	1 M $\Omega$ to 9.76 M $\Omega$
10M0 to 97M6	10 M $\Omega$ to 97.6 M $\Omega$
100M to 976M	100 M $\Omega$ to 976 M $\Omega$
1G00 to 9G76	1 G $\Omega$ to 9.76 G $\Omega$
10G0 to 97G6	10 G $\Omega$ to 97.6 G $\Omega$
100G to 976G	100 G $\Omega$ to 976 G $\Omega$
1T00 to 9T76	1 T $\Omega$ to 9.76 T $\Omega$
10T0 to 97T6	10 T $\Omega$ to 97.6 T $\Omega$
100T to 976T	100 T $\Omega$ to 976 T $\Omega$

## MIL-R-49462A

TABLE III. Standard resistance values for the 1 to 10 decade for 1.0, 2.0, 5.0, 10.0, and 20.0 percent resistance tolerances. 1/

1.0	2.0 5.0	10.0	20.0	1.0	2.0 5.0	10.0	20.0	1.0	2.0 5.0	10.0	20.0
10.00	10.00	10.00	10.00	23.20				49.90			
10.20				23.70					51.00		
10.50				24.30	24.00			51.10			
10.70				24.90				52.30			
11.00	11.00			25.50				53.60			
11.30				26.10				54.90			
11.50				26.70					56.00	56.00	
11.80				27.00	27.00			56.20			
12.00	12.00	12.00		27.40				57.50			
12.10				28.00				59.00			
12.40				28.70				60.40			
12.70				29.40				61.90			
13.00	13.00			30.10	30.00			62.00			
13.30				30.90				63.40			
13.70				31.60				64.90			
14.00				32.40				66.50			
14.30				33.00	33.00	33.00		68.00	68.00	68.00	
14.70				34.00				68.10			
15.00	15.00	15.00	15.00	34.80				69.80			
15.40				35.70				71.50			
15.80				36.50				73.20			
16.00	16.00			37.40				75.00	75.00		
16.20				38.30				76.80			
16.50				39.00	39.00			78.70			
16.90								80.60			
17.40									82.00	82.00	
17.80								82.50			
18.00	18.00										

TABLE III. Standard resistance values for the 1 to 10 decade for 1.0, 2.0, 5.0, 10.0, and 20.0 percent resistance tolerances - Continued. 1/

1.0	2.0 5.0	10.0	20.0	1.0	2.0 5.0	10.0	20.0	1.0	2.0 5.0	10.0	20.0
18.20				39.20				84.50			
18.70				40.20				86.60			
19.10				41.20				88.70			
19.60				42.20				90.90	91.00		
20.00	20.00			43.00	43.00			93.10			
20.50				43.20				95.30			
21.00				44.20				97.60			
21.50				45.30							
21.60				46.40							
22.00	22.00	22.00	22.00	47.00	47.00	47.00	47.00				
22.10				47.50							
22.60				48.70							

1/ See table I for applicable resistance tolerances.

TABLE IV. Resistance tolerance. 1/ 2/

Symbol	Resistance tolerance percent (%)
F	1.0
G	2.0
J	5.0
K	10.0
L	20.0

1/ Minimum and maximum resistance values may vary with tolerance (see 3.1).

2/ See table I for applicable resistance tolerances.

### 3. REQUIREMENTS

3.1 Detail requirements. The individual item requirements shall be as specified herein and in accordance with the applicable detail specification. In the event of any conflict between the requirements of this specification and the detail specification, the latter shall govern.

3.2 Qualification. High voltage resistors furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.4 and 6.3).

3.3 Material. The material shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the resistors to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product. Materials shall be corrosion resistant or shall be processed to resist corrosion.

3.4 Design and construction. Resistors shall be of the design, construction, and physical dimensions specified (see 3.1). Each resistor shall consist of a film type resistance element protected against exposure to humidity by an enclosure or coating of moisture resistant insulating material.

3.4.1 Terminals. Terminal leads shall be free of foreign material and solderable in the clean lead to clean lead area. Leads shall be judged to be free of foreign material if the visual criteria are met (see 3.9).

3.4.1.1 Solder dip (retinning) leads. The manufacturer may solder dip/retin the leads of product supplied to this specification provided the solder dip process has been approved by the qualifying activity.

3.4.1.2 Qualifying activity approval. Approval of the solder dip process will be based on one of the following options:

- a. When the original lead finish qualified was hot solder dip lead finish 52 of MIL-STD-1276 (NOTE: The 200-microinch maximum thickness is not applicable). The manufacturer shall use the same solder dip process for retinning as is used in the original manufacture of the product.
- b. When the lead originally qualified was not hot solder dip lead finish 52 of MIL-STD-1276 as prescribed in (a), approval for the process to be used for solder dip shall be based on the following test procedure:
  - (1) Thirty samples of any resistance value for each style and lead finish are subjected to the manufacturers solder dip process. Following the solder dip process, the resistors are subjected to the dc resistance test. No defects are allowed.
  - (2) Ten of the 30 samples are then subjected to the solderability test. No defects are allowed.
  - (3) The remaining 20 samples are subjected to the resistance to solder heat test followed by the moisture resistance test (NOTE: Solder dip of gold plated leads is not allowed).

3.4.1.3 Solder dip/retraining options. The manufacturer may solder dip/retrain as follows:

- a. After the 100 percent group A screening tests. Following the solder dip/retraining process, the electrical measurements required in group A, subgroup 1 100 percent screening tests shall be repeated on 100 percent of the lot (NOTE: The manufacturer may solder dip/retrain prior to the 100-percent electrical measurements of the group A subgroup 1 tests). The percentage defective allowable (PDA) for the electrical measurements shall be as for the subgroup 1 tests.
- b. As a corrective action if the lot fails the group A solderability test.

3.4.2 Films. The films shall be uniformly deposited. The film shall be free of blisters, thin spots, areas inadequately bonded to the core, discolored spots or other blemishes likely to cause flaking or a nonuniform ribbon when spiraled (helixed). Where used, spiraling shall occupy no less than 70 percent of the resistor-element actual length. The resistor-element actual length shall be defined as the nominal distance between terminal bands less 0.046875 inch.

3.4.2.1 Carbon films. Carbon films shall not be used.

3.4.3 End caps. When end caps are used in construction of the resistor, the misalignment of the cap with respect to the core shall not exceed 5°.

3.5 Power rating. Power rating is based on continuous full load operation at a rated ambient temperature. See the applicable associated detail specification for the applicable derating curve.

3.6 Voltage rating. Resistors shall have a rated dc continuous working voltage or an approximate sine-wave root-mean-square (rms) continuous working voltage corresponding to the wattage (power) rating, as determined from the following formula:

$$E = \sqrt{PR}$$

Where: E = continuous rated dc or rms working voltage in volts  
 P = rated wattage in watts  
 R = nominal resistance in ohms

In no case shall the rated voltage be greater than the applicable maximum voltage.

3.7 DC resistance. When resistors are tested as specified in 4.7, the dc resistance shall be within the specified tolerance of the nominal resistance (see 1.2.1.3), and shall be stable within the specified tolerance during the measurement.

3.8 Power conditioning. When resistors are tested as specified in 4.8, there shall be no evidence of mechanical damage and the change in resistance shall not exceed ±0.5 percent.

3.9 Solderability. The dipped surface of the leads of the resistor tested as specified in 4.9, shall be at least 95 percent covered with a new, smooth coating and shall exhibit no demetalization or leaching of terminal areas. The remaining 5 percent may contain only pin holes or rough spots, which shall not be concentrated in one area. In case of dispute, the percentage of coverage with pinholes or rough spots shall be determined by actual measurement of these areas, as compared to the total area.

3.10 Resistance to solvents. When resistors are tested as specified in 4.10, there shall be no evidence of mechanical damage and marking shall remain legible.



3.11 Thermal shock. When resistors are tested as specified in 4.11, there shall be no evidence of mechanical damage. The change in resistance shall not exceed  $\pm 0.5$  percent.

3.12 Low temperature operation. When resistors are tested as specified in 4.12, there shall be no evidence of mechanical damage, and the change in resistance between the initial and final measurement at  $+25^{\circ}\text{C} \pm 5^{\circ}\text{C}$  shall not exceed  $\pm (0.25 \text{ percent} + 0.05 \text{ ohm})$ .

3.13 Terminal strength. When resistors are tested as specified in 4.13, there shall be no evidence of breaking or chipping of the coating. The change in resistance shall not exceed  $\pm 0.2$  percent.

3.14 Dielectric withstanding voltage. When resistors are tested as specified in 4.14, there shall be no evidence of flashover, mechanical damage, arcing, or insulation breakdown. The change in resistance shall not exceed  $\pm 0.25$  percent.

3.15 Insulation resistance. When resistors are tested as specified in 4.15, the insulation resistance shall not be less than 10,000 megohms.

3.16 Moisture resistance. When resistors are tested as specified in 4.16, there shall be no evidence of mechanical damage. The change in resistance between initial measurement and final measurements shall not exceed  $\pm 0.5$  percent. In addition, the dielectric withstanding voltage shall be as specified in 3.14, and insulation resistance shall be 100 megohms, minimum.

3.17 Life. When resistors are tested as specified in 4.17, there shall be no evidence of mechanical damage. The change in resistance between initial measurement and any succeeding measurements shall not exceed 5 percent.

3.18 Resistance-temperature characteristic. When resistors are tested as specified in 4.18, the resistance-temperature characteristic, at each of the temperatures specified in table X referred to room ambient temperature, shall not exceed 200 ppm/ $^{\circ}\text{C}$  for resistance values less than 500 megohms and 500 ppm/ $^{\circ}\text{C}$  for resistance values greater than or equal to 500 megohms.

3.19 Shock. When resistors are tested as specified in 4.19, there shall be no evidence of mechanical damage or electrical damage. The change in resistance shall not exceed  $\pm 2.0$  percent and there shall be no electrical discontinuity during testing.

3.20 Vibration, high frequency. When resistors are tested as specified in 4.20, there shall be no evidence of mechanical damage. The change in resistance shall not exceed  $\pm 2$  percent and there shall be no electrical discontinuity during the test.

3.21 Outgassing (see 3.1). When tested as specified in 4.21, the samples shall meet the following requirements:

Total mass loss (TML): Shall not exceed 1.0 percent.

Volatile condensable material (VCM): Shall not exceed 0.1 percent.

3.22 Marking. Each resistor shall be marked in accordance with method I of MIL-STD-1285 and as indicated below:

- a. Manufacturer's code symbol.
- b. PIN.
- c. Manufacturing data code.

3.23 Workmanship. Resistors shall be processed in such a manner as to be uniform in quality and shall meet the requirements of 3.3 through 3.4.1 herein, and also 3.9 as applicable. Resistors must be free from other defects that will affect life, serviceability, or appearance.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractors overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring equipment shall be in accordance with MIL-STD-45662.

4.2 Classification of inspections. The inspections specified herein are classified as follows:

- a. Qualification inspection (see 4.4).
- b. Quality conformance inspection (see 4.5).

#### 4.3 Inspection conditions and precautions.

4.3.1 Conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS" of MIL-STD-202.

4.3.2 Precautions. Adequate precautions shall be taken during inspections to prevent condensation of moisture on resistors, except during moisture resistance test and thermal shock tests. Precautions shall also be taken to prevent damage by heat when soldering resistor leads to terminals.

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3) on sample units produced with equipment and procedures normally used in production.

4.4.1 Sample. The number of sample units comprising a sample of resistors to be submitted for qualification inspection shall be as specified in the appendix to this specification. The sample size shall be taken at random from a production run and shall be produced with equipment and procedures normally used in production. The sample units shall have been subjected to and passed the requirements of group A inspection (see 4.5.1.2). Qualification shall not be granted if group A inspection requirements are not met.

4.4.2 Test routine. Sample units will be subjected to the qualification inspection specified in table Y in the order shown. All sample units will be subjected to the inspection of group I. The 60 sample units of 5 percent resistance tolerance will then be divided as specified in table Y for groups II to V, inclusive and subjected to the inspection for their particular group. When applicable 10 additional sample units will be submitted to the inspection of group VI. When approval for a lower resistance tolerance is desired, 20 additional sample units will be submitted to the inspection of group I.

4.4.3 Failures. Failures in excess of those allowed in table Y shall be cause for refusal to grant qualification.

4.4.4 Retention of qualification. To retain qualification, the contractor shall forward a report at 6-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

- a. A summary of the results of the tests performed for inspection of product for delivery (groups A and B), indicating as a minimum the number of lots that have passed, the number that have failed, and the group which they failed. The results of tests of all reworked lots shall be identified and accounted for.
- b. A summary of the results of tests performed for periodic inspection (group C), including the number and mode of failures. The summary shall include results of all periodic inspection tests performed and completed during the 6-month period. If the summary of the tests indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products lists.

Failure to submit the report within 30 days after the end of each 6-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 6-month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during two consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit his qualified products to testing in accordance with the qualification inspection requirements and the reason for no production.

TABLE Y. Qualification inspection.

Inspection	Requirement paragraph	Method paragraph	Number of sample units for inspection	Number of defects allowed	
<u>Group I</u>					
Visual and mechanical	3.1, 3.4, 3.4.1, 3.23	4.6.1	All samples	0	
DC resistance	3.7	4.7			
Power conditioning	3.8	4.8			
<u>Group IA</u>					
Solderability	3.9	4.9	12 sample units any value	1	2
Resistance to solvents	3.10	4.10			
<u>Group II</u>					
Thermal shock	3.11	4.11	5 high	1	
Low temperature operation	3.12	4.12	5 critical		
Terminal strength	3.13	4.13	5 low		
<u>Group III</u>					
Dielectric withstanding voltage	3.14	4.14	5 high	1	
Insulation resistance	3.15	4.15	5 critical		
Thermal shock	3.16	4.11	5 low		
Moisture resistance	3.16	4.16			
<u>Group IV</u>					
Life	3.17	4.17	5 high	1	2
Resistance-temperature characteristic	3.18	4.18	5 critical		
			5 low		
<u>Group V</u>					
Shock	3.19	4.19	5 high	1	
Vibration, high frequency	3.20	4.20	5 critical		
			5 low		
<u>Group VI</u>					
Outgassing (when applicable) (see 3.1)	3.21	4.21	10 sample units any value	0	

#### 4.5 Quality conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspection.

4.5.1.1 Inspection lot. An inspection lot, as far as practicable, shall consist of all resistors of the same style, characteristic, and protective enclosure or coating.

4.5.1.2 Group A inspection. Group A inspection shall consist of the inspections specified in table VI and shall be made on the same set of sample units, in the order shown.

##### 4.5.1.2.1 Sampling plan.

4.5.1.2.1.1 Subgroup 1. Subgroup 1 tests shall be performed on 100 percent of the product supplied under this specification. Resistors that are out of resistance tolerance, or which experience a change in resistance greater than that permitted for the tests of this subgroup shall be removed from the lot. Lots having more than 10-percent total rejects, due to exceeding the specified resistance change limit shall not be furnished on contracts.

4.5.1.2.1.2 Manufacturer's production inspection. If the manufacturer performs tests similar to those specified in subgroup 1, table VI as the final step of the production process, group A, subgroup 1, inspection may be waived and the data resulting from the manufacturer's production tests may be used instead. Authority to waive the subgroup 1 inspection shall be granted by the qualifying activity only. The following criteria shall be met.

- a. Tests conducted by the manufacturer during production shall be identical to or more stringent than those specified for subgroup 1. Test conditions shall be equal to or more stringent than those specified for subgroup 1 tests.
- b. Manufacturer subjects 100 percent of the product supplied under this specification to his production tests.
- c. The parameters measured and the failure criteria shall be the same or more stringent than those specified herein.
- d. The lot rejection criteria is the same or more stringent than that specified herein.
- e. The manufacturer shall make available all information concerning the test procedures and instrumentation used in his production tests. The manufacturer shall also make available to the Government all records of all detail test data resulting from production tests.
- f. Once approved, the manufacturer shall not change the test procedures or criteria without prior notification and concurrence by the qualifying activity.

TABLE VI. Group A inspection.

Inspection	Requirement paragraph	Method paragraph	
<u>Subgroup I</u>			100% inspection
Thermal shock	3.11	4.11	
Power conditioning	3.8	4.8	
DC resistance	3.7	4.7	
<u>Subgroup II</u>			
Visual and mechanical examination:		4.6.1	See 4.5.1.2.1.3
Body dimensions	3.1	4.6.1	
Diameter and length of leads	3.1	4.6.1	
Marking 1/	3.22	4.6.1	
Workmanship	3.23	4.6.1	
<u>Subgroup III</u>			
Solderability	3.9	4.9	See 4.5.1.2.1.4

1/ Marking defects shall be charged only for illegible, incorrect, or incomplete marking. Any subsequent electrical defect shall not be charged as a marking defect.

4.5.1.2.1.3 Subgroup II. Subgroup II tests shall be performed on an inspection lot basis. A sample of 13 parts shall be randomly selected, if one or more defects are found, the lot shall be rescreened and defects removed. A new sample of 13 parts shall be randomly selected. If one or more defects are found in this second sample, the lot shall be rejected and shall not be supplied to this specification.

#### 4.5.1.2.1.4 Subgroup III (solderability).

4.5.1.2.1.4.1 Sampling plan. Thirteen samples shall be selected randomly from each inspection lot and subjected to the subgroup III solderability test. The manufacturer may use electrical rejects from the subgroup I screening tests for all or part of the samples to be used for solderability testing. If there are one or more defects, the lot shall be considered to have failed.

4.5.1.2.1.4.2 Rejected lots. In the event of one or more defects, the inspection lot is rejected. The manufacturer may use one of the following options to rework the lot:

- a. Each production lot that was used to form the failed inspection lot shall be individually submitted to the solderability test as required in 4.9. Production lots that pass the solderability tests are available for shipment. Production lots failing the solderability test can be reworked only if submitted to the solder dip procedure as specified in 4.5.1.2.1.4.2b.

- b. The manufacturer submits the failed lot to a 100-percent solder dip using an approved solder dip process in accordance with 3.4.1.1. Following the solder dip, the electrical measurements required in group A subgroup 1 tests shall be repeated on 100 percent of the lot. The PDA for the electrical measurements shall be as for the subgroup 1 tests. Thirteen additional samples shall be then selected and subjected to the solderability test with zero defects allowed. If the lot fails this solderability test, the lot shall be considered rejected and shall not be furnished against the requirements of this specification.

4.5.1.2.1.4.3 Disposition of samples. The solderability test is considered a destructive test and samples submitted to the solderability test shall not be supplied on the contract.

4.5.1.3 Group B inspection. Group B inspection shall consist of the inspections specified in table VII in the order shown. They shall be performed on sample units that have been subjected to and passed the group A inspection.

TABLE VII. Group B inspection.

Inspection	Requirement paragraph	Method paragraph
Resistance-temperature characteristic	3.18	4.18
Dielectric withstanding voltage	3.14	4.14
Thermal shock	3.11	4.11

4.5.1.3.1 Sampling plan. Group B tests shall be performed on an inspection lot basis. A sample of 13 parts shall be randomly selected. If one or more defects are found, the lot shall be rescreened and defects removed. A new sample of 13 parts shall be randomly selected. If one or more defects are found in this second sample, the lot shall be rejected and shall not be supplied to this specification.

4.5.2 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.5.2.1.7), delivery of products which have passed groups A and B inspections shall not be delayed pending the results of these periodic inspections.

4.5.2.1 Group C inspection. Group C inspection shall consist of the tests specified in table VIII in the order shown. Group C inspection shall be performed on sample units of each style and selected from inspection lots which have passed groups A and B inspections. Group C inspection samples shall be representative of production.



TABLE VIII. Group C inspection.

Inspection	Requirement paragraph	Method paragraph
<u>Monthly</u> (10 sample units)		
Thermal shock	3.11	4.11
Low temperature operation	3.12	4.12
Terminal strength	3.13	4.13
<u>Quarterly</u>		
Subgroup I - 10 sample units		
Dielectric withstanding voltage	3.14	4.14
Insulation resistance	3.15	4.15
Thermal shock	3.11	4.11
Moisture resistance	3.16	4.16
Subgroup II - 10 sample units		
Life	3.17	4.17
<u>Semiannual</u> (10 sample units)		
Solderability	3.9	4.9
Shock	3.19	4.19
Vibration, high frequency	3.20	4.20

**4.5.2.1.1 Sampling plan.**

**4.5.2.1.2 Monthly.** Every month, 10 sample units of each style, characteristic, and body enclosure of any resistance value between the critical and lowest values shall be inspected. If none of these resistance values are produced during the month, resistors of the lowest resistance value produced shall be inspected with one defective unit allowed. If this sample fails, 10 additional sample units shall be inspected with no defectives allowed, but no more than two defectives allowed for all 20 sample units combined.

**4.5.2.1.3 Quarterly.** Every 3 months, 20 sample units of each style, characteristic, and body enclosure of any resistance value between the critical and highest values shall be inspected. Ten sample units of any resistance value between the critical and highest values shall be subjected to the inspection of subgroup I, and 10 sample units of the value closest to the value above the critical value shall be subjected to the inspection of subgroup 2. One defective unit will be allowed for each subgroup, but not more than one defective for the two groups combined.

**4.5.2.1.4 Semiannually.** Every 6 months, 10 sample units of each style, characteristic, and body enclosure of any resistance value between the critical and highest resistance values shall be inspected with one defective unit allowed.

**4.5.2.1.5 Defectives.** If the number of defectives exceed the number allowed in 4.5.2.1.4, the sample shall be considered to have failed.

**4.5.2.1.6 Disposition of samples.** Sample units which have been subjected to group C inspection shall not be delivered on the contract or purchase order.



4.5.2.1.7. Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall notify the qualifying activity and cognizant inspection activity of such a failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which are manufactured under essentially the same conditions, with the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action acceptable to the qualifying activity has been taken. After corrective action has been taken, group C inspection shall be repeated on additional sample units (all tests and examinations, or the test which the original sample failed, at the option of the qualifying activity). Groups A and B inspections may be reinstituted; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity.

4.5.3 Inspection of packaging. The sampling and inspection of the preservation, packing, and container marking shall be in accordance with the requirements of MIL-K-39032.

#### 4.6 Methods of inspection.

4.6.1 Visual and mechanical examination. Resistors shall be examined to verify that the materials, design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.1 and 3.4 to 3.4.1 and 3.23 inclusive).

4.7 DC resistance (see 3.7). The dc resistance shall be measured in accordance with method 303 of MIL-STD-202. The following details and exceptions shall apply:

- a. Measuring apparatus: The same measuring instrument shall be used for any one test, but not necessarily for all tests.
- b. Test voltage: Measurements of resistance shall be made by using the test voltages specified in table IX. The test voltage chosen, whether it be the maximum or a lower voltage which would still provide the sensitivity required, shall be applied across the terminals of the resistor. This same voltage shall be used whenever a subsequent resistance measurement is made.
- c. Temperature: The dc resistance test specified in group I of table V shall be performed at  $+25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ . For all other tests, unless otherwise specified herein, the temperature at which subsequent and final resistance measurements are made in each test shall be within  $\pm 2^{\circ}\text{C}$  of the temperature at which the initial resistance measurement was made.
- d. Humidity: Humidity shall be 50 percent.

TABLE IX. DC resistance test voltages.

Resistance, nominal (ohms)	Maximum test voltage (volts)
100 to 976 inclusive	3
1,000 to 9,760 inclusive	10
10,000 to 97,600 inclusive	30
100,000 or higher	100

#### 4.8 Power conditioning (see 3.8).

4.8.1 Mounting. Resistors may be mounted in any position and allotted as much space as necessary. Forced air cooling may be used to maintain a test ambient temperature of  $+20^{\circ}\text{C}$  to  $+45^{\circ}\text{C}$ . The velocity of the forced air shall not exceed 500 feet per minute and there shall be no direct impingement of the forced air upon the resistors.

4.8.2 Procedure. The load applied shall be 1.5 times rated power for a duration of  $100 \pm 8$  hours, not to exceed the maximum voltage specified (see 3.1). The voltage applied may be rectified ac or dc. DC resistance shall be measured before and after the test following a 2-hour stabilization period at  $+25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ . Resistors shall be examined for evidence of arcing, burning, or charring.

4.9 Solderability (see 3.9). Resistors shall be tested in accordance with method 208 of MIL-STD-202. Both leads shall be tested.

#### 4.10 Resistance to solvents (see 3.10).

4.10.1 Procedure. Resistors shall be tested in accordance with method 215, MIL-STD-202. The following details shall apply:

- a. The marked portion of the resistor body shall be brushed.
- b. The number of sample units shall be as specified in table X1.

4.11 Thermal shock (see 3.11). Resistors shall be tested in accordance with method 107 of MIL-STD-202. The following details and exceptions shall apply:

- a. Mounting: Resistors shall be mounted by means other than soldering.
- b. Measurement before cycling: DC resistance shall be measured as specified in 4.7.
- c. Test condition letter: B, except that the extreme high temperature shall be  $+150^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ,  $-0^{\circ}\text{C}$ .
- d. Measurement after cycling: Within 3 hours after completion of the final cycle and as soon as the resistors stabilize at room temperature, dc resistance shall again be measured as specified in 4.7.
- e. Examination after test: Resistors shall be examined for evidence of mechanical damage.

#### 4.12 Low temperature operation (see 3.12).

4.12.1 Mounting. Resistors shall be mounted in such a manner that there is at least 1 inch of free air space around each resistor, and in such a position with respect to the air stream that the mounting offers substantially no obstruction to the flow of air across and around the resistors.

4.12.2 Procedure. DC resistance shall be measured as specified in 4.7. Within 1 hour after this measurement, the resistors shall be placed in a cold chamber at a temperature of  $-65^{\circ}\text{C} \pm 2^{\circ}\text{C}$  for a period of  $24 \pm 4$  hours. The resistors shall then be removed from the chamber and maintained at a temperature of  $+25^{\circ}\text{C} \pm 5^{\circ}\text{C}$  for a period of approximately 2 to 8 hours; the dc resistance shall again be measured as specified in 4.7. Resistors shall then be examined for evidence of mechanical damage.

4.13 Terminal strength (see 3.13). DC resistance shall be measured as specified in 4.7. Each resistor lead will have a 16 ±1 ounce weight clamped to each lead in turn. Each lead shall be subjected to four 90° arcs (an arc is defined as the movement of the lead away from the original position through 90° from the original position and back to the original position). The dc resistance shall then be again measured as specified in 4.7. Resistors shall then be examined for evidence of breaking, loosening of terminals and chipping of glass.

4.14 Dielectric withstanding voltage (see 3.14).

4.14.1 Atmospheric pressure. Resistors shall be tested in accordance with method 301 of MIL-STD-202. The following details and exceptions shall apply:

a. Special preparations:

- (1) Cylindrical body with axial leads. Resistors shall be clamped in the trough of a 90° metallic V-block of such size that the body of the resistor does not extend beyond the extremities of the block. The resistor leads shall be so positioned that the distance between the resistor lead and any point of the V-block is not less than the radius of the resistor minus the radius of the lead wire.
- (2) Flat body resistors with radial leads. Resistors shall be clamped between two metal plates of such size that the body of the resistor does not exceed beyond the extremities of the metal plates (see figure 1).

- b. Initial measurement: DC resistance shall be measured as specified in 4.7.
- c. Nature of potential: Alternating current (ac) supply at commercial line frequency (not more than 100 hertz and waveform).
- d. Magnitude of test potential: Sine wave test potential of 900 volts rms.
- e. Duration of application of test voltages: 1 minute.
- f. Rate of application of test voltage: 100 volts per second.
- g. Points of application of test voltage: Between the resistor terminals connected together and the V-block.
- h. Measurement after test: DC resistance shall be measured as specified in 4.7.
- i. Examinations after test: Resistors shall be examined for evidence of flashover, mechanical damage, arcing, and insulation breakdown.

4.14.2 Barometric pressure (reduced). Resistors shall be tested in accordance with method 105 of MIL-STD-202. The following details and exceptions shall apply:

- a. Method of mounting: As specified in 4.14.1a.
- b. Initial measurement: DC resistance shall be measured as specified in 4.7.
- c. Test voltage during subjection to reduced pressure: 450 volts rms.
- d. Test condition letter: B.
- e. Nature of potential: As specified in 4.14.1c.
- f. Duration of test: 1 minute.

- g. Points of application of test voltage: As specified in 4.14.1g.
- h. Measurements after test: DC resistance shall be measured as specified in 4.7.

4.15 Insulation resistance (see 3.15). Resistors shall be tested in accordance with method 302 of MIL-STD-202. The following details and exceptions shall apply:

- a. Special preparations: As specified in 4.14.1a1.
- b. Test condition letter: A or B, whichever is practicable.
- c. Points of measurement: Between the resistor terminals connected together and the V-block.

4.16 Moisture resistance (see 3.16). Resistors shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

- a. Mounting: Soldered by their leads to rigid mounts or terminal lugs. The spacing of the mounts or terminals lugs shall be such that the length of each resistor lead is approximately .375 inch when measured from the edge of the supporting terminal to the resistor body. One half of the sample units shall be covered with a V-shaped metal strap whose width is .750 inch (see figures 1 and 2). The strap shall be made of a corrosion-resistant metal and shall be kept in contact with the resistor body by supporting the body with a nonconducting, noncorrosive support whose width is less than that of the body and which will not act as a moisture trap. The mounting straps may be individual for each resistor or continuous for all resistors.
- b. Polarization and loading voltage:
  - (1) Polarization: During steps 1 to 6, inclusive, a 100 volt dc potential shall be applied only to those resistors which have a polarizing strap. This potential shall be applied with the positive lead connected to the resistor terminals tied together, and the negative lead connected to the polarizing straps.
  - (2) Loading voltage: During the first 2 hours of steps 1 and 4, a dc test potential equivalent to 100 percent rated wattage, but not exceeding 500 volts dc shall be applied to those resistors which are mounted by their leads without the polarizing straps specified in 4.16a.
- c. Subcycle: Step 7a shall be performed during any five of the first eight cycles only. All polarizing straps shall be removed to perform step 7a and shall then be replaced prior to returning the resistors to the humidity chamber.
- d. Final measurements: Upon completion of step 6 of the final cycle, the resistors shall be held at the high-humidity condition and at a temperature of  $+25^{\circ}\text{C} \pm 2^{\circ}\text{C}$  for a period of 1 hour 30 minutes to 3 hours 30 minutes. The same straps used for polarizing the resistors may also be used for the dielectric withstanding voltage and insulation resistance tests. Resistors shall be removed from the chamber and within 30 minutes, without any additional handling, the dc resistance, dielectric withstanding voltage, and insulation resistance shall be measured in that order as specified in 4.7, 4.14, and 4.15 respectively. The sample units shall not be subjected to forced circulating air during the tests.
- e. Examination after test: Resistors shall be examined for evidence of mechanical damage.

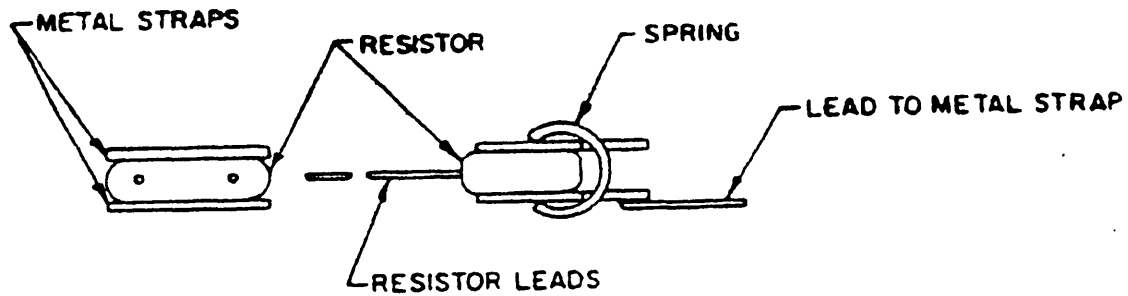


FIGURE 1. Metal strap assembly for flat body resistors.

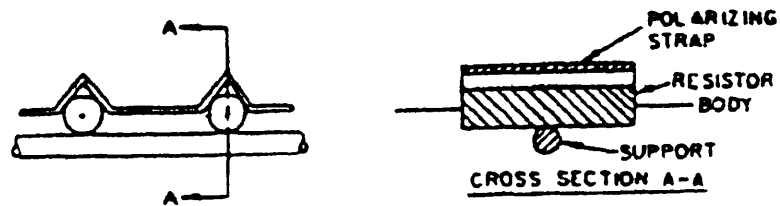


FIGURE 2. Mounting straps for cylindrical resistors.

MIL-R-49462A

4.17 Life (see 3.17). Resistors shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

- a. Method of mounting: Resistors shall be mounted and soldered on lightweight terminals. The effective length of each terminal shall be 1 inch. Resistors shall be arranged that the temperature of any one resistor shall not influence the temperature of any other resistor. There shall be no undue draft over the resistors.
- b. Test temperature:  $+25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .
- c. Initial measurement: DC resistance shall be measured at the applicable test temperature after temperature stabilization and within 8 hours of exposure of the resistors to the test temperatures.
- d. Operating conditions: Rated dc continuous working voltage shall be applied intermittently, 45 minutes on and 15 minutes off, for 1,000 hours.
- e. Test condition: D.
- f. Measurements during test: DC resistance shall be measured at the end of the 30-minutes off periods, after 50  $\pm 8$ , 100  $\pm 8$ , 250  $\pm 8$ , 500  $\pm 12$ , 750  $\pm 12$ , and 1,000  $\pm 12$  hours have elapsed.
- g. Examination after test: Resistors shall be examined for evidence of mechanical damage.

4.18 Resistance temperature characteristics (see 3.18). Resistors shall be tested in accordance with method 304 of MIL-STD-202. The following details and exceptions shall apply:

- a. Reference temperature: Room ambient temperature.
- b. Test temperature: In accordance with table X herein.
- c. Accuracy of temperature measurement: Resistors shall be maintained for 30 to 45 minutes within  $1^{\circ}\text{C}$  at each of the test temperatures as specified in table X herein. This tolerance shall be maintained at the established test temperatures.

TABLE X. Resistance temperature characteristic.

Sequence	Temperature $^{\circ}\text{C}$ <sup>1/</sup>	
	Qualification inspection	Group B inspection
1	Room temperature <sup>2/</sup>	Room temperature <sup>2/</sup>
2	$-16^{\circ}\text{C} \pm 3^{\circ}\text{C}$	$-55^{\circ}\text{C} \pm 3^{\circ}\text{C}$
3	$-55^{\circ}\text{C} \pm 3^{\circ}\text{C}$	Room temperature <sup>2/</sup>
4	Room temperature <sup>2/</sup>	---
5	$+65^{\circ}\text{C} \pm 3^{\circ}\text{C}$	$+175^{\circ}\text{C} \pm 3^{\circ}\text{C}$
6	$+125^{\circ}\text{C} \pm 3^{\circ}\text{C}$	---
7	$+175^{\circ}\text{C} \pm 3^{\circ}\text{C}$	---

<sup>1/</sup> At the option of the manufacturer the reverse sequence may be as follows:

- 1 Room temperature
- 2  $+175^{\circ}\text{C} \pm 3^{\circ}\text{C}$
- 3 Room temperature
- 4  $-55^{\circ}\text{C} \pm 3^{\circ}\text{C}$

<sup>2/</sup> This temperature shall be considered the reference temperature for each of the succeeding temperatures.

**4.19 Shock (specified pulse) (see 3.19).** Resistors shall be tested in accordance with method 213 of MIL-STD-202. The following details and exceptions shall apply:

- a. **Special mounting means:** Resistors shall be rigidly mounted on an appropriate jig fixtures with their leads supported at a distance of 0.25 inch from the resistor body. The resistor shall be mounted with body clamped or cemented to a flat surface. Where used, the cement material shall not extend above the center line in the horizontal plane or beyond the resistor body in the vertical plane. In no case shall the resistor body be completely encapsulated. These fixtures shall be constructed in a manner to insure that the points of the resistor mounting supports will have the same motion as the shock table. Test leads used during this test shall be no larger than AWG size 22 stranded wire (not applicable for resistance values greater than 10 megohms). The test lead strength shall be no greater than is necessary. In all cases, the resistors shall be mounted in such a manner that the stress applied is in the direction which would be considered most detrimental.
- b. **Measurement before shock:** DC resistance shall be measured as specified in 4.7.
- c. **Number and direction of applied shocks:** The resistors shall be subjected to a total of 10 shocks in each of two mutually perpendicular planes, 1 perpendicular and the other parallel to the longitudinal axis of the resistor.
- d. **Test condition:** 1 (100 G's, 6 ms sawtooth).
- e. **Measurement during shock (not applicable for resistance values greater than 10 megohms):** Each resistor shall be monitored to determine electrical discontinuity by a method which shall at least be sensitive enough to monitor or register, automatically, any electrical discontinuity of 0.1 ms or greater duration.
- f. **Measurement after shock:** DC resistance shall be measured as specified in 4.7.
- g. **Examination after test:** Resistors shall be examined for evidence of mechanical and electrical damage.

**4.20 Vibration, high frequency (see 3.20).** Resistors shall be tested in accordance with method 204 of MIL-STD-202. The following details and exceptions shall apply:

- a. **Mounting of specimens:** Resistors shall be mounted on appropriate jig fixtures as specified in 4.19a. These fixtures shall be constructed in a manner to insure that the points of the resistor-mounting supports will have the same motion as the vibration test table. The fixtures shall also be of a construction that will preclude any resonance in the fixture when subjected to vibration within the test range and the fixture shall be monitored for these features on the vibration table. A shielded cable containing test leads no larger than AWG 22 stranded wire shall be clamped to the resistor mounting fixture. The test lead length shall be no greater than necessary.
- b. **Initial measurement:** DC resistance shall be measured as specified in 4.7.
- c. **Test condition:** D (10 to 2,000 Hz, 20 G)
- d. **Direction of motion:** In each of two mutually perpendicular planes, one perpendicular and the other parallel to the longitudinal axis of the resistor. Duration shall be 4 hours in each plane with total test time of 8 hours.



- e. Measurements during vibration (not applicable to resistance values greater than 10 megohms): Each resistor shall be monitored to determine electrical discontinuity by a method which shall at least be sensitive enough to monitor or register, automatically, any electrical discontinuity of 0.1 ms or greater duration.
- f. Measurement after vibration: DC resistance shall be measured as specified in 4.7.
- g. Examination after test: Resistors shall be examined for evidence of mechanical damage.

4.21 Outgassing (see 3.21). Samples of any materials used shall be cut into pieces having 0.38 inch (9.65 mm) maximum dimension. A sample of 100 to 300 milligrams of material shall be weighed and then placed in a vacuum chamber under the following conditions:

Pressure: 10<sub>-6</sub> torr or less.

Temperature of specimen: Maximum operating temperature of device.

Exposure time: 24 hours.

During this exposure, a collector plate 9.7 inches (246.4 mm) in diameter shall be held at +25°C ±1°C near the sample. Immediately upon removal of the specimen and collector plate from the chamber, they shall be weighed. The Total Mass Loss (TML) is sample mass before exposure minus the sample mass after exposure divided by the initial sample mass (expressed in percent change). The Volatile Condensable Material (VCM) is the increase in the weight of the collector plate divided by the mass of sample (expressed in percent).

## 5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-R-39032.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Resistors described herein are intended to be used in electronic circuits where high voltages and high resistance are required.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).
- c. Title, number, and date of the applicable associated detailed specification, and the complete PIN.



**6.3 Qualification.** With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List No. 49462 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the US Army Laboratory Command; Fort Monmouth, NJ 07703-5000, however, information pertaining to qualification of products may be obtained from Defense Electronics Supply Center (DESC-E), 1507 Wilmington Pike, Dayton, OH 45444-5000 and information pertaining to qualification of products may be obtained from the activity.

**6.4 Application notes.**

**6.4.1 Voltage coefficient.** Typical voltage coefficients for high voltage resistors are 200 ppm/volt.

**6.5 Subject term (key word) listing.**

High ohmic values

**6.6 Changes from previous issue.** Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

## APPENDIX

## PROCEDURE FOR QUALIFICATION INSPECTION

## 10. SCOPE

10.1 Scope. This appendix details the procedure for submission of samples, with related data, for qualification inspection of resistors covered by this specification. The procedure for extending qualification of the required sample to other resistors covered by this specification is also outlined herein. This appendix is a mandatory part of this specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

30. Submission. A sample having any specification resistance tolerance in each style and characteristic for which qualification is sought shall be submitted and subjected to the inspection of table V. Sample size submission and distribution shall be as in table XI as follows:

30.1 Test data. When examinations and tests are to be performed at a Government laboratory, prior to submission, all sample units shall be subjected to all of the tests indicated as nondestructive in table V. Each submission shall be accompanied by test data obtained from these tests. The performance of the destructive examinations and tests by the manufacturer on a duplicate set of sample units is encouraged, although not required, all test data shall be submitted in duplicate.

30.2 Description of items. The manufacturer shall submit a detailed description of the resistors being submitted for inspection, including materials used for the resistance element and protective enclosure or coating and lead material. After qualification has been granted, no changes shall be made in materials, design, or construction without prior notification to the qualifying activity.

## APPENDIX

TABLE XI. Qualification inspection; sample size, submission and distribution. <sup>1/</sup>

Sample size	Submission	Distribution
<u>Group I</u>	72	20 high 20 critical 20 low
All samples		
<u>Group IA</u>		
12 samples any value		
<u>Group II</u>		
5 high		
5 critical <sup>2/</sup>		
5 low		
<u>Group III</u>		
5 high		
5 critical <sup>2/</sup>		
5 low		
<u>Group IV</u>	72	12 any value group IA
5 high		
5 critical <sup>2/</sup>		
5 low		
<u>Group V</u>		
5 high		
5 critical		
5 low		
<u>Group VI</u>		
10 samples any value (see 3.1)		

<sup>1/</sup> Groups from table V.<sup>2/</sup> If no critical value is specified, the samples shall be equally divided between the highest and lowest resistance values submitted (see table XII for critical resistance values).

## APPENDIX

TABLE XII. Critical resistance values.

Style	Resistor value (ohms)
RHV10, RHV36	4.42 M
RHV11, RHV37	3.92 M
RHV12, RHV38	16.5 M
RHV13, RHV39	17.8 M
RHV14, RHV40	48.7 M
RHV15, RHV41	75.0 M
RHV16, RHV42	100.0 M
RHV17, RHV43	150.0 M
RHV18, RHV44	29.4 M
RHV19, RHV45	49.9 M
RHV20, RHV46	61.9 M
RHV21	59.0 M
RHV22	4.42 M
RHV23	7.68 M
RHV24	14.0 M
RHV25	124.0 M
RHV26	56.2 M
RHV27	69.8 M
RHV28	82.5 M
RHV29	110.0 M
RHV30	2.21 M
RHV31	4.42 M
RHV32	8.87 M
RHV33	12.4 M
RHV34	33.2 M
RHV35	78.7 M
RHV50	5.36 M
RHV51	6.19 M
RHV52	16.5 M
RHV53	49.9 M
RHV54	16.2 M
RHV55	36.5 M
RHV56	57.6 M
RHV57	84.5 M

## 40. EXTENT OF QUALIFICATION

40.1 Extention of qualification. The resistance range included in the qualification of any one resistor style will be between the lowest and highest resistance values which pass qualification inspection (see 3.1). Qualification of the lower resistance tolerances will qualify for the higher resistance tolerances in accordance with table XIII. Extent of qualification by style shall be in accordance with table XIV. As a requisite for extention of qualification as described herein between tolerances and styles, the product involved must be manufactured using the same facilities, processes, and materials as the product originally submitted for qualification.

## APPENDIX

TABLE XIII. Extent of qualification of resistance tolerance.

Resistance tolerance submitted	Resistance tolerance qualified
F G J	F, G, J G, J J

TABLE XIV. Extent of qualification by style.

Style	Will qualify style(s)
RHV57	RHV57, RHV56, RHV55, RHV54, RHV53, RHV52, RHV51, RHV50
RHV56	RHV56, RHV55, RHV54, RHV53, RHV52, RHV51, RHV50
RHV55	RHV55, RHV54, RHV53, RHV52, RHV51, RHV50
RHV54	RHV54, RHV53, RHV52, RHV51, RHV50
RHV53	RHV53, RHV52, RHV51, RHV50
RHV52	RHV52, RHV51, RHV50
RHV51	RHV51, RHV50
RHV50	RHV50
RHV47	RHV47, RHV46, RHV45, RHV44, RHV43, RHV42, RHV41, RHV40, RHV39, RHV38, RHV37, RHV36
RHV46	RHV46, RHV45, RHV44, RHV43, RHV42, RHV41, RHV40, RHV39, RHV38, RHV37, RHV36
RHV45	RHV45, RHV44, RHV43, RHV42, RHV41, RHV40, RHV39, RHV38, RHV37, RHV36
RHV44	RHV44, RHV43, RHV42, RHV41, RHV40, RHV39, RHV38, RHV37, RHV36
RHV43	RHV43, RHV42, RHV41, RHV40, RHV39, RHV38, RHV37, RHV36
RHV42	RHV42, RHV41, RHV40, RHV39, RHV38, RHV37, RHV36
RHV41	RHV41, RHV40, RHV39, RHV38, RHV37, RHV36
RHV40	RHV40, RHV39, RHV38, RHV37, RHV36
RHV39	RHV39, RHV38, RHV37, RHV36
RHV38	RHV38, RHV37, RHV36
RHV37	RHV37, RHV36
RHV36	RHV36

## APPENDIX

TABLE XIV. Extent of qualification by style - Continued.

Style	Will qualify style(s)
RHV35	RHV35, RHV34, RHV33, RHV32, RHV31, RHV30
RHV34	RHV34, RHV33, RHV32, RHV31, RHV30
RHV33	RHV33, RHV32, RHV31, RHV30
RHV32	RHV32, RHV31, RHV30
RHV31	RHV31, RHV30
RHV30	RHV30
RHV29	RHV29, RHV28, RHV27, RHV26, RHV25, RHV24, RHV23, RHV22
RHV28	RHV28, RHV27, RHV26, RHV25, RHV24, RHV23, RHV22
RHV27	RHV27, RHV26, RHV25, RHV24, RHV23, RHV22
RHV26	RHV26, RHV25, RHV24, RHV23, RHV22
RHV25	RHV25, RHV24, RHV23, RHV22
RHV24	RHV24, RHV23, RHV22
RHV23	RHV23, RHV22
RHV22	RHV22
RHV21	RHV21, RHV20, RHV19, RHV18, RHV17, RHV16, RHV15, RHV14, RHV13, RHV12, RHV11, RHV10
RHV20	RHV20, RHV19, RHV18, RHV17, RHV16, RHV15, RHV14, RHV13, RHV12, RHV11, RHV10
RHV19	RHV19, RHV18, RHV17, RHV16, RHV15, RHV14, RHV13, RHV12, RHV11, RHV10
RHV18	RHV18, RHV17, RHV16, RHV15, RHV14, RHV13, RHV12, RHV11, RHV10
RHV17	RHV17, RHV16, RHV15, RHV14, RHV13, RHV12, RHV11, RHV10
RHV16	RHV16, RHV15, RHV14, RHV13, RHV12, RHV11, RHV10
RHV15	RHV15, RHV14, RHV13, RHV12, RHV11, RHV10
RHV14	RHV14, RHV13, RHV12, RHV11, RHV10
RHV13	RHV13, RHV12, RHV11, RHV10
RHV12	RHV12, RHV11, RHV10
RHV11	RHV11, RHV10
RHV10	RHV10

CONCLUDING MATERIAL

Custodians:

Army - ER  
Navy - EC  
Air Force - 85  
NASA - MA

Review activities:

Army - AR, MI  
Navy - AS, OS  
Air Force - 17  
DLA - ES

User activities:

Army - AT, AV, ME  
Navy - CG, MC  
Air Force - 19

Preparing activity:  
Army - ER

Agent:  
DLA - ES

(Project 5905-1218)

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

<b>RECOMMEND A CHANGE</b>	1. DOCUMENT NUMBER MIL-R-49462A	2. DOCUMENT DATE (YYMMDD) 910315
---------------------------	------------------------------------	-------------------------------------

### DOCUMENT TITLE

Resistors, Fixed, Film, High Voltage, General Specification for

NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

### REASON FOR RECOMMENDATION

SUBMITTER	STANDARDIZATION
NAME	DATE SUBMITTED
ADDRESS	TELEPHONE
	(1) COMMERCIAL
	(2) AUTOVON
	(3) TELETYPE

### PREPARING ACTIVITY

NAME Army Laboratory Command	b. TELEPHONE (Include Area Code) (1) Commercial (908) 544-3441 (2) AUTOVON 995-3441
ADDRESS (Include Zip Code) ATTN: SICET-RS Fort Monmouth, NJ 07703-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340